assist in finding the quantity of seeds required, the number of seeds to the seer is given, where known, for each kind of tree in the list of suitable trees.

CHAPTER VI

PROPAGATION OF TREES; NURSERIES

Methods of propagation

1. There are various methods of propagating trees :—

(1) Direct sowing of seed where the tree is required to be grown;

(2) Sowing the seed in seed-beds and transplanting direct to site.

(3) Sowing the seed in a seed-bed transplanting the young seedlings into pots or into the ground in the nursery, and then planting them out in their permanent positions when they are large enough;

(4) Planting cuttings ;

(5) Detaching and planting root-suckers.

Of these methods, Nos. (3) is the most importnat for those for whose guidance this manual is intended. For roadside tree-planting, the method of transplanting the seedlings into pots or baskets is the best. Cuttings may be used in the case of species which do not seed freely ; or, in order to obtain plants of some size, as in the case of the different species of Ficus which root fairly readily. An avenue (of Babul, for instance) can be reared, by sowing seed in situ, in prepared pits, along the sides of the road and afterwards thinning out the seedlings.

Selection of sites for nurseries

2. In selecting the nursery, the following are the chief considerations to be taken into account, viz., (1) locality, (2) facilities for obtaining water, (3) shade requirements, (4) soil, (5) facility for supervision. The site of the nursery should be above the level of floods and as near as possible to the road or portion of a road which is to be planted. It should be made large enough to meet the requirements for which it is made. It will often be found convenient as already stated to establish a nursery in the compound of an Inspection Bungalow, where

the bungalow chaukidar or Mali can tend it and inspecting officers can from time to time watch progress and see that their Instructions are being properly carried out. A never-failing supply of water from a well or from a tank or canal is indispensable. A site with a few shady trees on it should be selected for a well-drained loam. Proper drainage should also be provided to allow water to run off. The nursery should be fenced. Plants can be sent considerable distances quite safely, provided they are properly prepared, packed, protected from the sun, given sufficient water and carefully transported to their destination. Local officers can, therefore, decide to locate their nurseries at such places as they consider will, from time to time, be most suitable for meeting the requirements of their respective districts.

Laying out nurseries

4. The ground should be dug and thoroughly worked to the depth of from 15 to 18 inches. If the soil is not quite suitable, it can be improved by the addition of such materials as appear to be required. Every nursery should have a pit wherein leaves can be stored and allowed to decay, in order to provide a supply of leaf-mould for manurial purposes. The nursery should be laid out in beds five feet wide, running, approximately, in the direction of the natural surface drainage, and the beds should be separated one from another by paths 2½ feet in width. In the monsoon the seeds should be sown on raised seed beds at least six inches from the ground. This prevents water-logging conditions in the seed-bed.

Preparation of beds and sowing of seeds

5. Before sowing, the soil in the beds should be broken very finely and have some finely-sifted leaf-mould or manure mixed with it. It should then be raked smooth ; then moistened, but not made so wet as to cause it to stick to the fingers at the time when the seed is being sown. The seed should be sown evenly, broadcast, and then covered with a thin layer of fine soil not deeper, as a rule, than twice the thickness of the seed itself ; or the surface of the bed may, simply, be raked.

Time for sowing ; watering ; protection and shade

6. It may be stated, as a general rule, that the proper time for sowing seed is the season when it is ripe and falls from the

tree. Seeds can, however, be sown at almost any time of the year, provided they receive proper attention in regard to shade and watering. Every nursery should be provided with, at least, one watering pot fitted with a fine-holed rose for watering seed-beds. From the time the seeds are sown till after the seedlings are above ground they will require constant and very careful attention in regard to watering and protection from animals birds and insects. For insects, ashes or lime may be sprinkled over the beds; while kerosene emulsion, tobacco water, or a weak solution of copper sulphate may be applied to plants by syringing (*vide* Appendix E). The beds should be shaded from the midday sun and from heavy rain by having bamboo mats placed over them. Caster-oil plants may usefully be grown to provide shade quickly.

Weeding, cultivation and thinning

7. The beds must be carefully weeded, and the surface broken up with a pointed iron pin after each irrigation, to prevent a "cake" forming. This loosening of the soil is necessary to enable the seedlings easily to force a way through it, and also to enable the young plants to grow properly. The seedlings must be carefully thinned by removing the weakly and ill-formed and leaving only the healthy and well-formed plants.

Transplanting

8. The next step will be to transplant the seedlings into pots or baskets. This may be done as soon as they are from 6 to 10 inches in height and the greatest care must be taken to lift the seedlings without harming the roots. If any root be broken, the broken portion should be cut off with a sharp knife. Dead or dying twigs or leaves should be removed by cutting or by hand picking. The seedlings should be lifted with the soil adhering to their roots, and this soil should not be removed till the seedling is being transplanted into the pot or basket. The pots or basket should all be ready beforehand, and the soil that is to be put into them should also be ready mixed with manure, so that there may be no delay between lifting the seedlings and replanting them. After the seedlings have been potted or basketed the pots or baskets should be neatly arranged in rows and kept in a shady place till the plants become established.

Season for transplanting

9. The season for transplanting depends much on the species of tree and on the climate. As a general rule it is

safest to wait till the rains break. Transplanting in winter is, however, often successful in the case of trees which are leafless in the cold weather.

Use of pots or baskets; lifting

10. It must rest with the local officers to decide whether pots or baskets should be used. In some localities earthen pots may be too expensive to warrant their use, but other conditions being the same, pots are perhaps more satisfactory. They should be from 7 to 9 inches in diameter. It is best to arrange the pots in shallow trenches so as to facilitate irrigation; and the pots should be moved occasionally to prevent the roots striking into the ground beneath. It is a common practice to bury the pots in the ground, but by doing this there is more danger of the roots penetrating into the earth beneath and being damaged when the pot is lifted. At least 50 per cent more plants than are actually required for planting should be potted. It is by no means indispensable to transplant into pots or baskets. The seedlings can be left to grow to a larger size if they are transplanted into the ground, in lines, 2½ feet apart, but the difficulty of "lifting" them is then much more serious; and unless a trained subordinate personally supervises the process, the Mali is sure to damage the roots, which spread very much further than when confined in a pot and become interlaced with the roots of the adjoining plants.

Propagation by cutting

11. As a rule straighter trees can be grown from seeds than from cuttings. In the case, however, of certain trees—like Sisso, and Mulberry—of which it is desired to raise a stock of plants quickly, cuttings may be made from 8 to 10 inches in length, and planted obliquely, fairly close together, in prepared beds in a shaded position in the nursery. As soon as the cuttings have become sufficiently well rooted, they should be potted and grown on in the nursery till such time as they are ready for permanent planting.

Also, large, straight, selected branches, 1 to 1½ inch in diameter from 3 to 5 feet in length, can be cut off the parent trees of the Banyan, the Pipal, and other members of the fig family, and also Pangara, Bombox malbaricum thespesia and planted as cuttings in a shaded position in a nursery. As soon as those which succeed have made a satisfactory amount of root growth,

they may be transplanted to the positions which they are intended to occupy permanently as roadside trees. As, however, the percentage of these large cuttings which will strike is always uncertain, the method is not recommended for general use. But in certain localities where rainfall is adequate the tree cutting mentioned above may be planted in "situ" after few heavy showers at the beginning of the monsoon. If the rains fail it will be necessary to water these cuttings by water cart.

CHAPTER VII

FORMATION OF AVENUES

Only large healthy seedlings to be planted

1. Only the healthiest and best shaped plants in the nursery should be planted along the roadsides. Sturdy young trees are wanted, and the planting out of forced or weakly seedlings must be rigidly prohibited. The young trees to be planted should be from 2 to 4 feet high. In proportion to their age, they should have good, straight, stout, well-developed, clean stems; and every care should be taken, when moving them, to cause as little injury to their roots as possible. The seedlings will usually be ready for planting out when they are from one to two years old. Wherever it is practicable, the plants should be conveyed in their pots or baskets to the roadside where they are to be planted—care being taken to protect them in every way in order to prevent them from flagging at any time. It is best to carry out the planting work during a spell of cloudy or damp weather.

Position of trees in relation to the roadway

2. Trees should never be planted on the very edge of the roadway, as the roots are liable in such cases to burst through the surface, damaging the road and tripping up bullocks and horses. In addition, the shade becomes too dense, and the trunks are dangerously close for passing carts. On the other hand, trees should never be planted on the extreme edge of the land belonging to a road running between cultivated fields as the shade will then injure the crops.